

# Exhibit 8

IN THE UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF VIRGINIA  
Alexandria Division

UNITED STATES OF AMERICA,  
Plaintiff,

v.  
ZACKARY ELLIS SANDERS,  
Defendant.

Case No. 1:20-cr-00143

Declaration of Seth Schoen

I, Seth Schoen, declare under penalty of perjury:

1. I am a computer technologist and privacy specialist. I reside in San Francisco, California.
2. From 2001 to 2020, I was a Senior Staff Technologist at the Electronic Frontier Foundation (“EFF”), a not-for-profit organization specializing in Internet users’ privacy and other legal issues.
3. EFF is the leading nonprofit organization defending technology users’ privacy, freedom of expression, and innovation in the digital world, through impact litigation, policy analysis, grassroots activism, and technology development. Founded in 1990, EFF combines the skills and expertise of leading technologists, activists, and attorneys in its efforts to advocate for people’s rights.
4. I am an expert in Tor and privacy technology. While I worked at EFF, the organization, from 2004 to 2005, supported Tor’s development. For the past 19 years, I’ve worked on privacy, Internet security, and technology issues. For the past 16 years, I’ve worked with Tor developers to promote public understanding of Tor, and I’ve educated the general public, defense attorneys, prosecutors, and judges about electronic privacy, including how Tor works and why people use it.
5. A copy of my CV is attached as Exhibit A.
6. I have been retained as an expert for the defense to explain the origins and uses of Tor, and I have reviewed discovery and pleadings related to the affidavit in support of the search warrant in this case.

**Tor is a privacy technology developed by the Tor Project, a non-profit organization.**

7. The Tor Project, Inc. (“The Tor Project”), a not-for-profit organization, is the main developer of the Tor Browser and the software behind the Tor network.
8. The Tor network and the Tor Browser work together to help people privately browse the web and limit the information they share about themselves.
9. The Tor network is composed of thousands of volunteers’ computer servers around the world. These computer servers are called Tor nodes.
10. When someone visits a web site using the Tor Browser, all the communications with the web site are sent through a Tor circuit, which is made up of three or more randomly chosen Tor

nodes, out of the thousands that make up the Tor network, passing through them before arriving at their destination.

11. Although the Tor network's privacy features make it more difficult to count its users compared to other software and services, available statistics suggest that the Tor network is currently used by about 2.5 million people each day.

### **The Tor Project exists to protect Internet users' privacy.**

12. The Tor Project describes its mission as: "To advance human rights and freedoms by creating and deploying free and open source anonymity and privacy technologies, supporting their unrestricted availability and use, and furthering their scientific and popular understanding."
13. The Tor Project and privacy researchers recognized that the network ought to be used by a diverse set of people with varying reasons for using the technology. Therefore, Tor developers have always realized that the privacy of any individual user is improved by the diversity of the users and purposes for which they use the software. Tor has always tried to attract a wide range of users.
14. Because people can be tracked in all sorts of ways when they go online, the Tor Project aims to help people make sure that their information isn't exposed or tracked in ways they don't want.
15. Internet ads are one example of why people care about this kind of protection. Internet ad companies often use "behavioral tracking," "behavioral profiling," and "behavioral targeting" to choose which ads to show people. That means that they look at what individuals do online, build profiles of those users' interests and activities, and later show them ads that might be relevant to those interests.
16. This can be a concern if users don't want companies to know about their interest in some topic. For example, someone searching for information on erectile dysfunction, herpes, adult incontinence, bankruptcy, gay bars, BDSM, fertility issues, pregnancy, or abortion might not want his or her interest to be known to a company, which could result in repeatedly being shown uncomfortably revealing ads on the topic in the future.
17. Using Tor for those searches helps break the connection between the sensitive topic and the identity of the person doing the search.

### **The U.S. government has been one of the main sponsors of Tor.**

18. The main technology behind Tor was invented by Dr. Paul Syverson, a researcher at the Naval Research Laboratory. The U.S. Navy sponsored Dr. Syverson's original research.
19. Tor development has been sponsored by the U.S. State Department, Defense Advanced Research Projects Agency, the Electronic Frontier Foundation, the Broadcasting Board of Governors (the parent of Voice of America and Radio Free Asia/Radio Liberty, now United States Agency for Global Media), and the Swedish government, as well as a wide range of other institutional and individual donors<sup>1</sup>.
20. Much of Tor's funding has come from government sources that want to promote Internet freedom.

### **People have many legitimate reasons for using Tor.**

21. Today, Internet users may want to limit the large amount of information about them that could otherwise be revealed and collected when they go online. Tor has features that can help reduce what people reveal about themselves and prevent several different forms of online tracking.

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<sup>1</sup> See <<https://www.torproject.org/about/sponsors/>> (listing fifty past and present governmental and institutional sponsors of the Tor Project).

*Tor helps people avoid companies' profiling of their interests.*

22. A web site or advertising network can build up a profile of a user's online activity and interests, often in order to target the user with related ads. Users may be uncomfortable with this, whether in general or with regard to specific interests, such as medical or sexual topics. Tor Browser includes various privacy features that make it harder for web sites to identify users and incorporate information from a visit into a larger user profile. These Tor Browser features help people keep private from companies their personal information that even their friends and family might not know.

*Tor helps people avoid targeted ads.*

23. Internet users may not want to have information about themselves added to ad databases, where that information might be used to influence them in ways they don't like or might unexpectedly reveal their interests to others. They might, for example, not want to have sensitive information about their travel plans, medical situations, sexual interests, socioeconomic status, etc., included in ad databases.

*Tor helps people avoid location tracking.*

24. A web site could tell approximately where in the world a user is accessing it from, or whether a user is currently coming from a known, habitual location. That would let web site operators infer and keep track of when a particular user is at home, at work, or on vacation; when particular users travel abroad; or even whether or not couples are accessing a service from the same location. People's locations can inherently be very sensitive and revealing, for example because someone could be accessing the Internet from a doctor's office, psychiatry clinic, fertility clinic, lawyer's office, etc. Using Tor can prevent sites from gathering this information.

*Tor helps people avoid geoblocking.*

25. Some web sites might be unavailable in certain regions or countries because the site operators are trying not to serve those parts of the world. For example, following the implementation of the European General Data Protection Regulation, which can be difficult to comply with, some U.S. media sites completely blocked access to their services to users who appear to be in Europe. Video streaming sites, such as YouTube, make certain music and television programs available only to users in certain jurisdictions. Those users can use Tor to see how the same sites would look from elsewhere in the world.

*Tor helps people avoid Internet censorship.*

26. Web sites can be unavailable in certain countries because of Internet censorship in those countries. Users can often use Tor to access sites that their governments block, a property that has led the U.S. government to fund Tor development for many years as part of its Internet freedom agenda.

*Tor helps people research things without revealing where they work.*

27. A journalist or a law enforcement agent researching a criminal enterprise would not want to visit the enterprise's web site directly from an IP address that could be associated with a particular media outlet or law enforcement agency. A lawyer performing a due-diligence investigation of a company for an investor (or preparing a lawsuit against the company) might

also not want the company to know about the lawyer's affiliation and interest. Tor can help prevent the operators of these sites from realizing where people who are visiting the sites work.

*Tor helps people send anonymous tips to journalists and law enforcement.*

28. Someone submitting a tip to a journalist or a law enforcement agency might not want to leave behind any information that could be used to trace the source of the tip. Tor can help ensure that the tip's recipient isn't in a position to reveal where the tip came from.

*Tor helps people not disclose their IP addresses.*

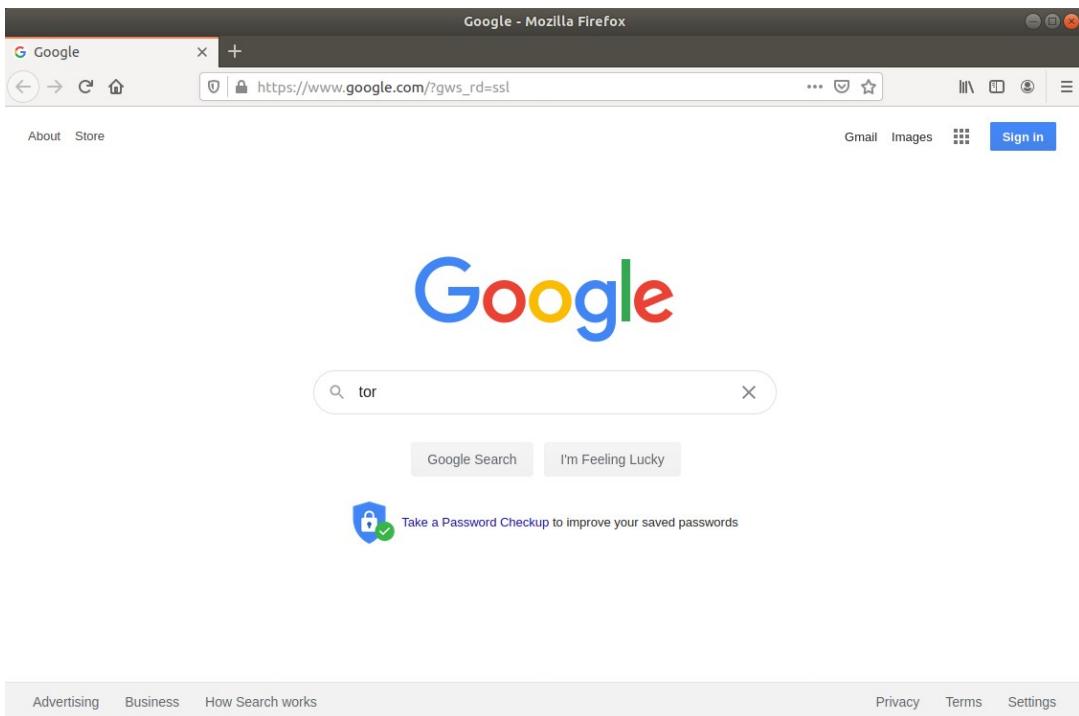
29. For the reasons discussed in paragraphs 22 to 28, Tor users benefit from Tor's behavior of not sharing the user's Internet Protocol address (IP address) with the sites that the user visits through Tor.
30. Typically, the Tor network succeeds in protecting the anonymity of a user's IP address from the sites the user visits, whether those are regular Internet web sites or onion service web sites. Instead of the user's own IP address, the web site operator would see the connection appear to originate from a so-called Tor exit node, one of the servers that forms part of the Tor network. The Tor exit node is randomly chosen by the user's Tor software, is shared by many different users, and has no particular connection with the user's identity or location. The Tor Browser also has multiple features to protect the anonymity of the user's IP address, including features to block certain "active content" such as certain scripts by default.
31. Not revealing the user's true IP address to sites the user visits is a core security goal of Tor.

**The Tor Browser is easy to download and use. The steps to download and use it are the same as those for any other non-default browser.**

32. Starting in 2008, the Tor Project created an integrated, easy-to-use product called the Tor Browser Bundle (now mainly referred to simply as "Tor Browser"), which consisted of a single download already set up with everything a user would need in order to browse over the Tor network.
33. The Tor Browser is an enhanced version of the Mozilla Firefox browser, a popular and frequently downloaded non-default web browser. Tor Browser mostly acts and works like Firefox, with the same features and interface. It also has customizations added by the Tor Project's developers to provide enhanced privacy features.
34. The Tor Project has continued to improve the ease of use and security of the Tor Browser since 2008. These enhancements to the Tor Browser are one of the Tor Project's core activities.
35. The Tor Browser works and looks like any other web browser that a user could download. It is available free of charge from the Tor Project's web site, and, once on a user's computer, provides a typical web browser interface that works much like any other web browser. The difference is that the Tor Browser is set up to always use the Tor network automatically for all of its connections.
36. The steps to download and use the Tor Browser are the same as those to download and use any other browser.
37. The Tor Browser is now straightforward and convenient enough to use that someone with limited computer knowledge can easily download and use it. According to a joint report by the American Civil Liberties Union, EFF, and the National Association of Criminal Defense Lawyers, "[u]sing Tor to browse anonymously or connect to hidden services is relatively

straightforward and does not require a high level of technical sophistication. In fact, following simple instructions, most Internet users can do it within five minutes.”<sup>2</sup>

38. The steps described below to download the Tor Browser and access the Tor network are the same steps that a user would take in order to make use of Tor for any of the legitimate reasons described in paragraphs 22 through 28 above. I took screenshots of this process, and true and accurate depictions of what I saw are included in the paragraphs below<sup>3</sup>.
39. A user can begin the process of downloading the Tor Browser by searching for “tor” in a search engine like Google:

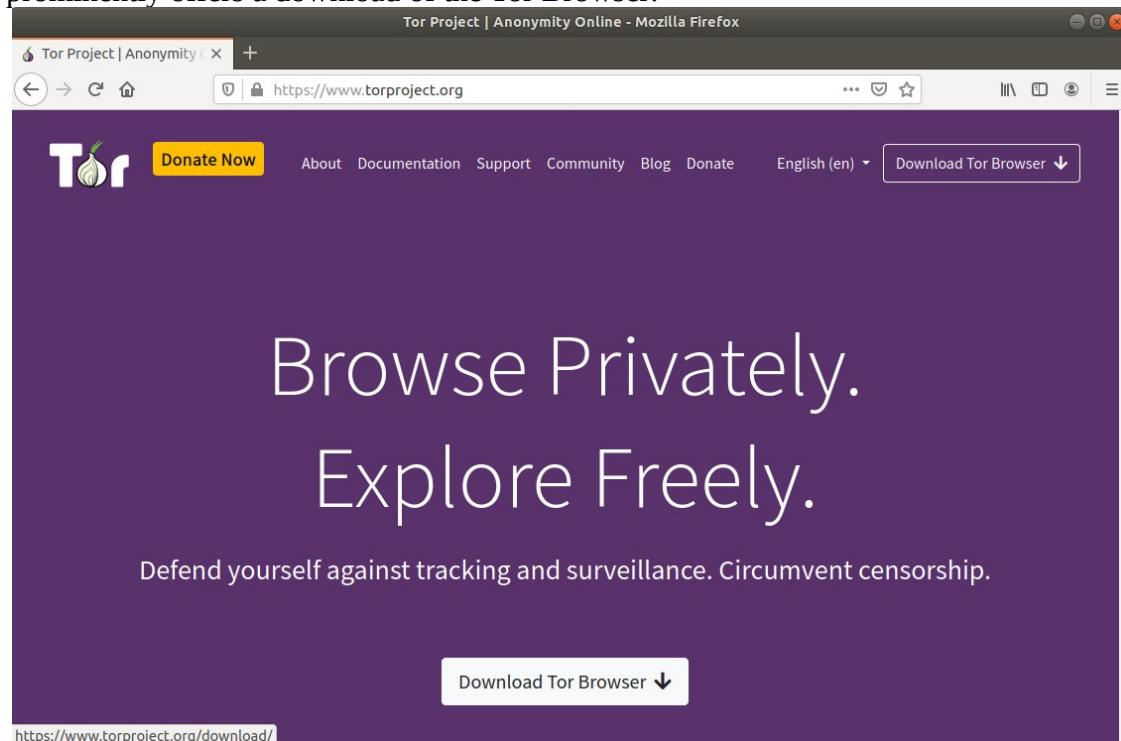


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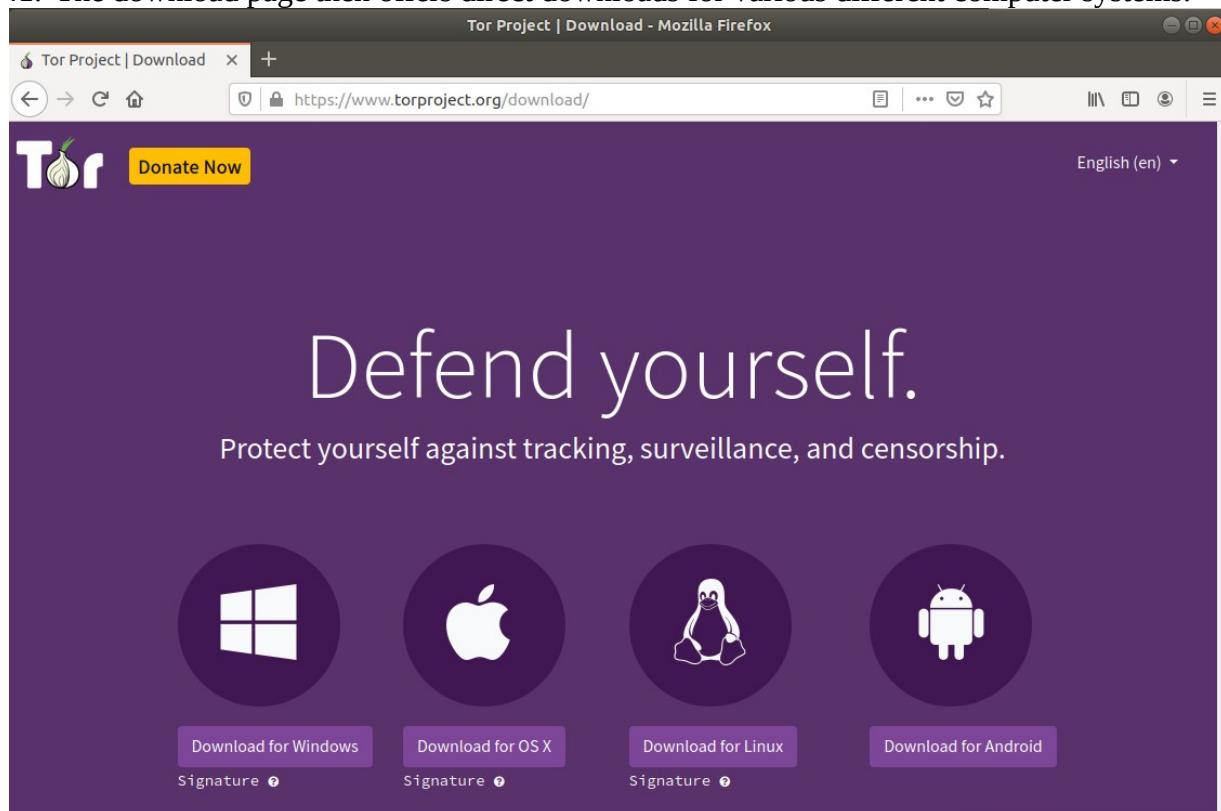
2 This report is available at <[https://www.aclu.org/sites/default/files/field\\_document/malware\\_guide\\_3-30-17-v2.pdf](https://www.aclu.org/sites/default/files/field_document/malware_guide_3-30-17-v2.pdf)>.

3 For purposes of clarity, some of the screenshots in the paragraphs that follow have been resized or cropped. The full versions of these screenshots are attached as Exhibit B.

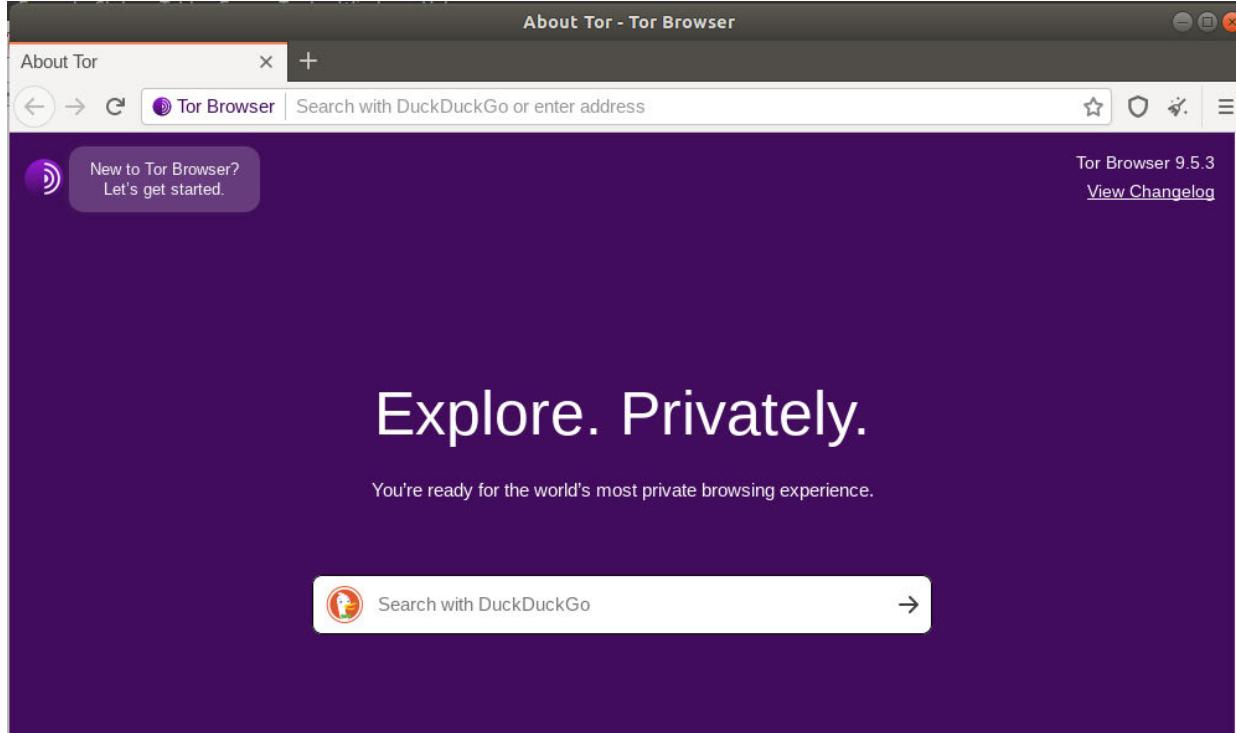
40. The user would then find the Tor Project's home page (as the top search result), which prominently offers a download of the Tor Browser:



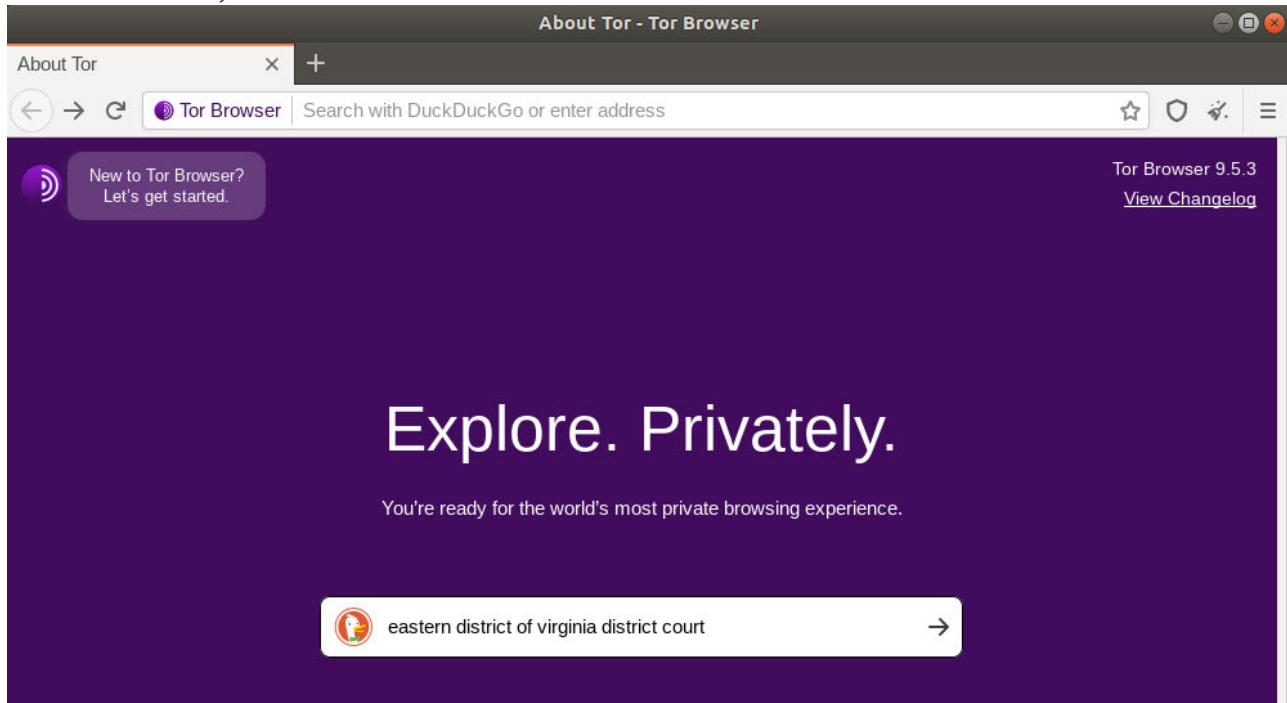
41. The download page then offers direct downloads for various different computer systems.



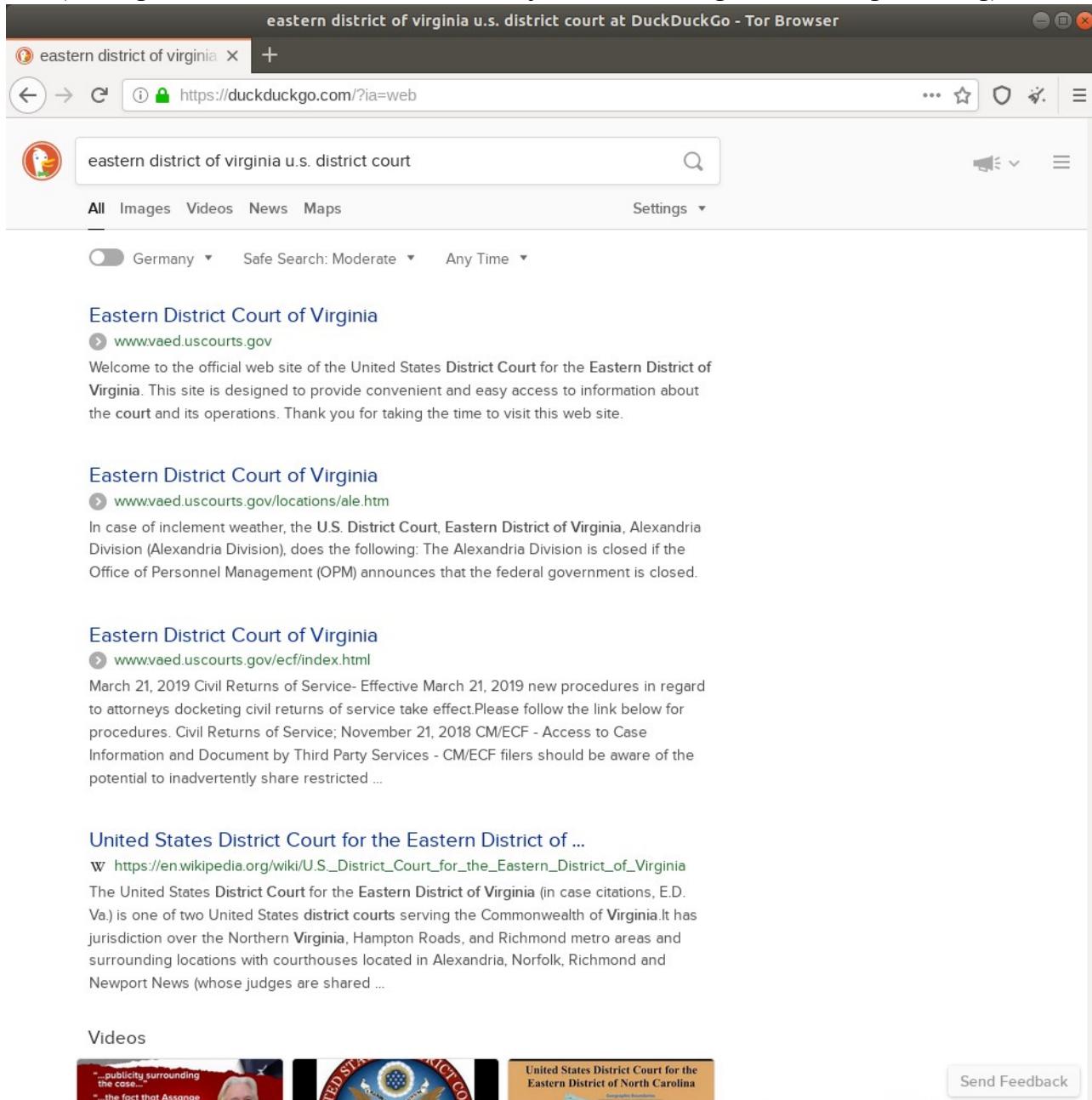
42. After downloading and installing Tor Browser from one of these links, a user can open it just like any other software application, typically by clicking on its icon.
43. Opening the **Tor Browser** then automatically accesses the Tor network and brings up an “About Tor” page inside the browser:



44. Users can search or type web addresses in the Tor Browser as with any other browser. In this screenshot, I entered a search for this Court’s web site.



45. The Tor Browser will automatically perform the search using the DuckDuckGo search engine (although users could also choose to use any other search engine, like Google or Bing).



The screenshot shows a search results page from DuckDuckGo. The search query is "eastern district of virginia u.s. district court". The results list several links to the official websites of the Eastern District of Virginia, including the Alexandria Division and the CM/ECF system. There are also links to the United States District Court for the Eastern District of Virginia and a Wikipedia page. The interface includes a search bar, a sidebar with filters for All, Images, Videos, News, and Maps, and a settings menu.

eastern district of virginia u.s. district court at DuckDuckGo - Tor Browser

eastern district of virginia x +

https://duckduckgo.com/?ia=web

eastern district of virginia u.s. district court

All Images Videos News Maps Settings

Germany Safe Search: Moderate Any Time

**Eastern District Court of Virginia**

wwwvaed.uscourts.gov

Welcome to the official web site of the United States District Court for the Eastern District of Virginia. This site is designed to provide convenient and easy access to information about the court and its operations. Thank you for taking the time to visit this web site.

**Eastern District Court of Virginia**

wwwvaed.uscourts.gov/locations/ale.htm

In case of inclement weather, the U.S. District Court, Eastern District of Virginia, Alexandria Division (Alexandria Division), does the following: The Alexandria Division is closed if the Office of Personnel Management (OPM) announces that the federal government is closed.

**Eastern District Court of Virginia**

wwwvaed.uscourts.gov/ecf/index.html

March 21, 2019 Civil Returns of Service- Effective March 21, 2019 new procedures in regard to attorneys docketing civil returns of service take effect. Please follow the link below for procedures. Civil Returns of Service; November 21, 2018 CM/ECF - Access to Case Information and Document by Third Party Services - CM/ECF filers should be aware of the potential to inadvertently share restricted ...

**United States District Court for the Eastern District of ...**

https://en.wikipedia.org/wiki/U.S.\_District\_Court\_for\_the\_Eastern\_District\_of\_Virginia

The United States District Court for the Eastern District of Virginia (in case citations, E.D. Va.) is one of two United States district courts serving the Commonwealth of Virginia. It has jurisdiction over the Northern Virginia, Hampton Roads, and Richmond metro areas and surrounding locations with courthouses located in Alexandria, Norfolk, Richmond and Newport News (whose judges are shared ...

Videos

Send Feedback

46. Finally, this image shows the Court's web site as visited with the current version of Tor Browser. The process of navigating to it, and the site's appearance, were much the same as in any other web browser.



47. The screenshots following paragraphs 39, 40, and 41 showed how someone could use a browser like Mozilla Firefox to find and download the Tor Browser. The screenshots following paragraphs 43, 44, 45, and 46 showed how someone could use the Tor Browser to find and visit this Court's web site. The Tor Browser download steps only need to be done once on a particular device, after which Tor Browser will be permanently installed on that device.

#### **People can stumble across web sites without knowing what they will contain.**

48. Internet users can easily visit web sites without knowing their contents, whether by clicking on search engine results or following a link that they found or received in some other way.

*Search results people see or click on can be different from what they expected or intended.*

49. Search engines have always had to contend with the way that words and phrases have different meanings in different contexts.
50. For example, an Internet user might search for “cardinals” or “pictures of cardinals”. They might find or click on web sites dedicated to various kinds of cardinals: a common bird in North America, the St. Louis Cardinals baseball team, or the members of the College of Cardinals in the Roman Catholic Church.
51. Many words and terms have multiple possible meanings, and these ambiguities create challenges for search engines and Internet users. Search engine developers try to find ways to guess which meaning would be most relevant or likely for a certain user, and which Internet sites would be most relevant for that user. They may also try to present some information that helps users guess what a web site is about, like an excerpt or “snippet” of that site’s content. These excerpts or snippets are necessarily incomplete and imperfect. It’s not unusual for Internet users to receive search results that are different from what they expected, or to be confused about the nature of a particular search result, or to click on a search result that’s not what they intended.
52. According to the documents I reviewed in this case, the Target Website was called [REDACTED]  
[REDACTED]  
[REDACTED]

*Search engines are almost always unable to show content for which a login is required.*

53. Web search engines obtain the web site content that they will use to select search results, and that they will show in excerpts or snippets, by “crawling” or “spidering” the web, meaning by visiting sites, and following links, with automated software on a large scale.
54. Apart from the exceptional case where site operators make special arrangements for a search engine operator (as with some large news sites like the *New York Times* and *Wall Street Journal* that otherwise require a paid subscription), the robots that perform this web crawling process can only access, at most, the same content that a user to a site could see without logging in.
55. That means that content that requires special access such as a login account is almost always invisible to web crawlers, and so not indexed by search engines and invisible to Internet users. For example, a search engine couldn’t see the content of a private discussion forum that required a login.
56. In this case, according to the affidavit, the Target Website required a “username and password” “in order to access the majority of the material” on the site. In that case, a search engine almost certainly could not have crawled and indexed that material, and it would have been invisible to Internet users when they made web searches that returned results for the target website.

*People click on links without knowing exactly where they will lead.*

57. Web sites (and their component web pages) are identified by hyperlinks, or “links<sup>4</sup>”.
58. Many times the content of a link’s target isn’t clear merely from examining the link.
59. For example, both of the video links [https://www.youtube.com/watch?v=0Ak\\_7tTxZrk](https://www.youtube.com/watch?v=0Ak_7tTxZrk) and <https://www.youtube.com/watch?v=2mBF2gSEEHQ> have a very similar appearance, with a meaningless data element at the end (“0Ak\_7tTxZrk” and “2mBF2gSEEHQ”). One of these videos is a performance of a Beethoven piano sonata, while the other is footage of the August

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<sup>4</sup> In this declaration, I use “link” instead of the more technically correct “URL”. While there is a technical difference between these two concepts, it isn’t relevant for any of the purposes of this declaration.

2020 explosion in the port of Beirut. But nothing about the links themselves would allow an Internet user to tell which was which, without visiting the sites.

60. We call links “opaque” when there’s no way to tell what they lead to just by looking at them.
61. Link shortening services also produce opaque links; one of <https://bit.ly/2XRd3IU> and <https://bit.ly/3izBkv8> will send Internet users to this Court’s web site, while the other points them to a Rick Astley music video. Again, there’s no way to tell which is which by inspecting the links without following them.
62. The opaque nature of links has allowed Internet users to trick others into visiting disturbing “shock sites”, by publicly posting misdescribed links that lead to shocking content. A more lighthearted prank is “rickrolling”, in which Internet users are tricked into viewing the Rick Astley video mentioned above when it’s not otherwise relevant<sup>5</sup>.
63. Users can, not uncommonly, get a link from a search engine or from another source and click on it without knowing any or all of the content that they’ll find on that particular page.
64. Someone who visits a web site only once is more likely to have found the content of that site was either not what they expected or not what they were looking for, compared to someone who visits a web site repeatedly.
65. In this case, an Internet user could have gotten a link to the Target Website from a search engine or from another source and clicked on it without knowing any or all of the content that they would find on that particular page.
66. Web sites can contain many different pages and a user visiting the home page won’t see those other pages without navigating to them. If portions of the web site require an account and password, a user doesn’t even have the ability to navigate to them without the account and password.
67. In this case, it appears that the Target Website contained many different pages, and a user visiting the home page wouldn’t see those pages without navigating to them. Because a username and password was required for “the majority of the material”, according to the affidavit, a user visiting the home page wouldn’t have been able to see the majority of the site’s content without at least registering and logging in.

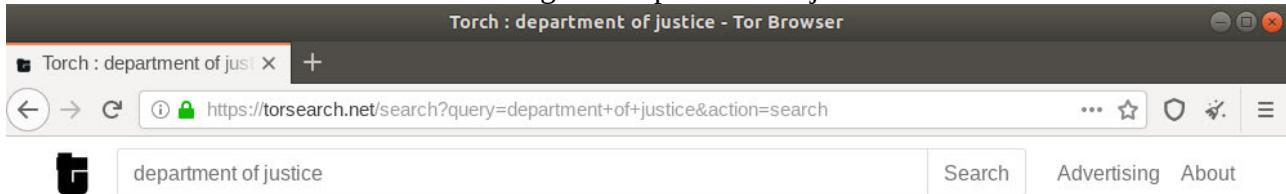
*Tor onion site links don’t always make obvious what the web site will contain.*

68. The Tor network provides a feature called Tor onion service sites (or onion sites). An onion site works much like an ordinary web site, but it can only be accessed through the Tor network. (The “onion” in the name of onion sites refers to the “onion routing” technology behind Tor, invented by Dr. Syverson.)
69. Within Tor Browser, links to onion sites can be used and visited just like other web sites. For example, a Tor Browser user can navigate to one simply by clicking on a search engine result or other link.
70. Unlike the names of ordinary web sites, however, onion sites’ names are generated with a random process. As a result, links to the home page of an onion site are, by default, opaque in the sense described above.
71. For example, a link like <https://3g2upl4pq6kufc4m.onion/> (which works inside of Tor Browser but not in other web browsers) offers no way to tell what it points to just by looking at it. (This link happens to point to an onion service of the web search engine DuckDuckGo.) By contrast, the equivalent non-onion link <https://www.duckduckgo.com/> would help someone viewing it guess that the target of the link was DuckDuckGo’s home page.

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<sup>5</sup> See Wikipedia, “Rickrolling”, available at <<https://en.wikipedia.org/w/index.php?title=Rickrolling&oldid=971877537>> (accessed August 11, 2020).

72. Some businesses have generated slightly less opaque onion site names by trying the link generation process over and over again on a computer until the result happens to look something like the business's name. For example, Facebook was able to create the onion site <https://facebookcorewwi.onion/> by having a computer try over and over again until the link happened to start with the word "facebook" and end with something that looked something like a word.
73. Most onion sites' addresses don't look like that. That is, they don't have any meaningful structure. The only way to be sure what sites they point to is to try visiting them.
74. It's also possible to find onion sites with a search engine like Torch. For example, this is a screenshot of the results of searching for "department of justice" on Torch:



Your search **department of justice** returned 5 results.

**usdoj.gov - documents | United States Department of Justice ...**

<http://rela7utlxcj4aasq.onion/usdoj.gov/documents/>

Usdoj.gov, United States Department of Justice documents. New era of Intelligence. Relations, contacts and documents about affiliated organizations.

**usdoj.gov - contacts | United States Department of Justice |...**

<http://rela7utlxcj4aasq.onion/usdoj.gov/contacts/>

Usdoj.gov, United States Department of Justice contacts. New era of Intelligence. Relations, contacts and documents about affiliated organizations.

**usdoj.gov - relations | United States Department of Justice ...**

<http://relatecxjngl4qs7.onion/usdoj.gov/>

Usdoj.gov, United States Department of Justice relations. New era of Intelligence. Relations, contacts and documents about affiliated organizations.

**usdoj.gov - documents | United States Department of Justice ...**

<http://relatecxjngl4qs7.onion/usdoj.gov/documents/>

Usdoj.gov, United States Department of Justice documents. New era of Intelligence. Relations, contacts and documents about affiliated organizations.

**usdoj.gov - contacts | United States Department of Justice |...**

<http://relatecxjngl4qs7.onion/usdoj.gov/contacts/>

Usdoj.gov, United States Department of Justice contacts. New era of Intelligence. Relations, contacts and documents about affiliated organizations.

Copyright © 2020 Torch (Tor Search Engine)

CN: [torsearch.net](https://torsearch.net) DW: [cnkj6nippubgycuj.onion](http://cnkj6nippubgycuj.onion)

75. These search results for Tor onion service web sites related to “department of justice” showed five results, all of which are located on the site <http://relatecxjngl4qs7.onion/>. The links and snippets in these search results don’t make clear who the operator of the site “relatecxjngl4qs7.onion” is, or what the nature or purpose of that site is. Nor does the name “relatecxjngl4qs7.onion” make clear who runs the site or what a user could expect to find there.
76. In this case, [REDACTED] shows that the Target Website’s home page would have been [REDACTED]. That also doesn’t make clear what the nature or purpose of the site is, or what a user could expect to find there. Therefore, an Internet user following a link to this site from a search result or another source could click on it without knowing what to expect.

*Tor users can use search engines to browse web sites on Tor onion services.*

77. To the extent the affidavit suggests that an Internet user could only have visited a Tor onion service by typing in its exact “16-or-56-character web address” or using a directory site, that inference is incorrect, since search engines for onion sites do exist and are relatively easy to use, and onion site links can be easily shared in any forum or medium. See also paragraph 74.

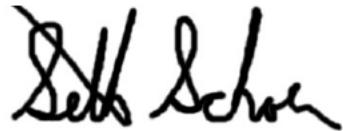
**On a forum like that on the Target Website, Internet users have to take affirmative steps to view specific content.**

78. The forum software used by [REDACTED] [REDACTED] [REDACTED] [REDACTED] of the phpBB forum software (including its theme and layout, icons, and navigation keywords). The phpBB software is one of the most popular tools for creating Internet discussion forums.
79. Exhibit C contains two screenshots of a public forum (about the phpBB software itself) using the phpBB software, [REDACTED] [REDACTED] [REDACTED] [REDACTED]
80. In a phpBB forum, users don’t see the images that have been posted in a forum topic unless they click on that individual topic. Users typically have to click on several links in order to view a specific forum topic or post.
81. In this case, the content of the FBI’s screenshot containing the post [REDACTED] [REDACTED] [REDACTED] does not appear to be the home page of the Target Website, but rather an individual post within the forum system which a user would have to navigate to in some way in order to view.
82. There are multiple reasons to believe that the post [REDACTED] [REDACTED] [REDACTED] [REDACTED] is most likely not the home page of the Target Website. For example, the address of the page displayed in the FBI’s screenshot is not simply [REDACTED] but rather [REDACTED] where the additional information [REDACTED] refers to selecting some specific forum content. I reviewed the phpBB open source code at <https://github.com/phpbb/area51-phpbb3/blob/master/phpBB/viewtopic.php> and confirmed that, for the phpBB software, “f” refers to “forum ID” and “t” refers to “topic ID”, meaning that the address of the page shown [REDACTED] on

this site. In addition, the so-called [REDACTED] reading [REDACTED] also refers to a subsidiary position of this content within the forums as a whole.

83. On a phpBB forum [REDACTED], creating an account and logging in can enable users to see and interact with password-protected portions of the forum (which represented [REDACTED], according to the affidavit), but after registering an account and logging in, users would still have to take affirmative steps to view specific content.

DONE this 18th day of August, 2020.

A handwritten signature in black ink, appearing to read "Seth Schoen".

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Seth D. Schoen

Exhibit A

## Seth D. Schoen

### Work experience

#### *Senior Linux Consultant, Linuxcare, Inc., 1999-2001*

- Created LNX-BBC operating system distribution
- Provided system administration consulting, support, and training

#### *Senior Staff Technologist, Electronic Frontier Foundation, 2001-2020*

- Founded EFF's Technology Projects team as the first Staff Technologist
- Advised attorneys on litigation matters
- Submitted declarations to numerous courts on electronic evidence and technology issues
- Testified before courts and regulatory agencies
- Taught journalists, prosecutors, defense attorneys, and judges about privacy technologies
- Spoke at more than 50 computer security, technology, and policy events in over a dozen countries
- Performed computer security and forensics research
- Co-created Let's Encrypt and Certbot projects, now the Internet's largest digital certificate authority
- Published whitepapers on privacy, consumer rights, forensics, and digital evidence topics
- Wrote commentary on current events in technology and law

#### *Consultant, IPv4 Extensions Project, 2020-present*

- Working to reclaim hundreds of millions of unused Internet Protocol addresses through updates to software and Internet standards

### Peer-reviewed publications

- Seth Schoen, "Compatibility, Competition, and Control in Trusted Computing Environments", *Information Security Technical Report* Vol. 10, Issue 2, 2005.
- J. Alex Halderman, Seth Schoen, Nadia Heninger, William Clarkson, William Paul, Joseph A. Calandrino, Ariel Feldman, Jacob Appelbaum, and Edward W. Felten, "Lest We Remember: Cold Boot Attacks on Encryption Keys," *Proceedings of 17th USENIX Security Symposium* (San Jose, California, August 2008), awarded best student paper, reprinted in *Communications of the ACM*, Vol. 52, Issue 5, 2009.
- Josh Aas, Richard Barnes, Benton Case, Zakir Durumeric, Peter Eckersley, Alan Flores-López, J. Alex Halderman, Jacob Hoffman-Andrews, James Kasten, Eric Rescorla, Seth Schoen, and Brad Warren, "Let's Encrypt: An Automated Certificate Authority to Encrypt the Entire Web," *Proceedings of ACM Conference on Computer and Communications Security* (London, November 2019).

### **Selected other publications**

- Co-author of *How to Bypass Internet Censorship* (FLOSS Manuals, 2008/2011), a guide created by two Internews workshops.
- Co-author of “Packet Forgery by ISPs: A Report on the Comcast Affair,” an EFF report cited by the Federal Communications Commission in a 2008 order against Comcast.

### **Agency testimony**

- U.S. Copyright Office (April 2003) – Triennial Anticircumvention Rulemaking Hearing
- U.S. Sentencing Commission (March 2009) – Hearing on Proposed Amendments for 2009
- U.S. Federal Trade Commission (February 2014) – FTC Spring Privacy Series: Mobile Device Tracking

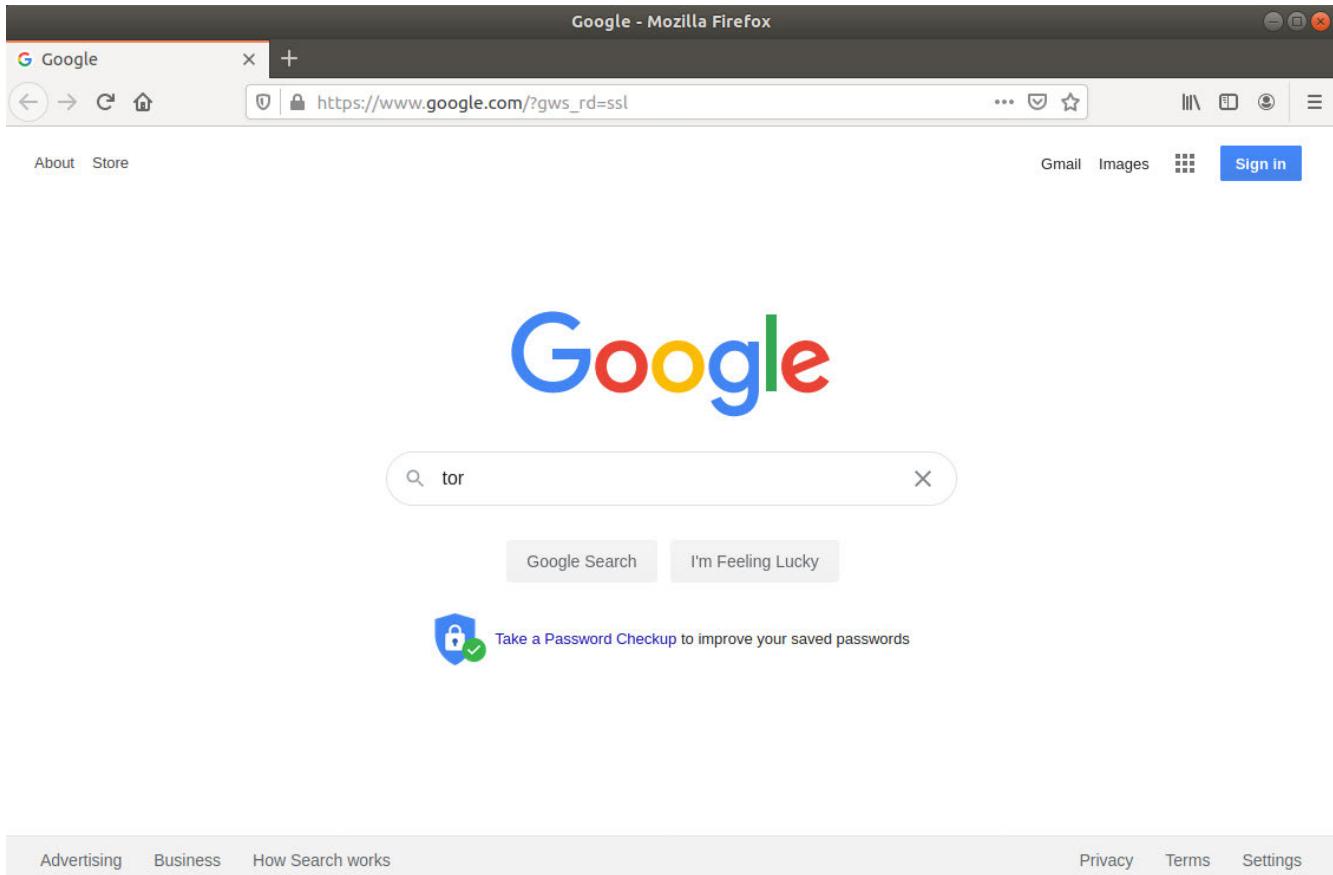
### **Selected other presentations**

- National Academies of Sciences, Engineering, and Medicine Committee on Law Enforcement and Intelligence Access to Plaintext Information in an Era of Widespread Strong Encryption: Options and Tradeoffs, Stanford University, January 2017.
- Innovation Caucus, Parliament of Canada, December 2017.

### **Languages spoken**

English, Brazilian Portuguese, German, Spanish

Exhibit B



Tor Project | Anonymity Online - Mozilla Firefox

Tor Project | Anonymity Online

https://www.torproject.org

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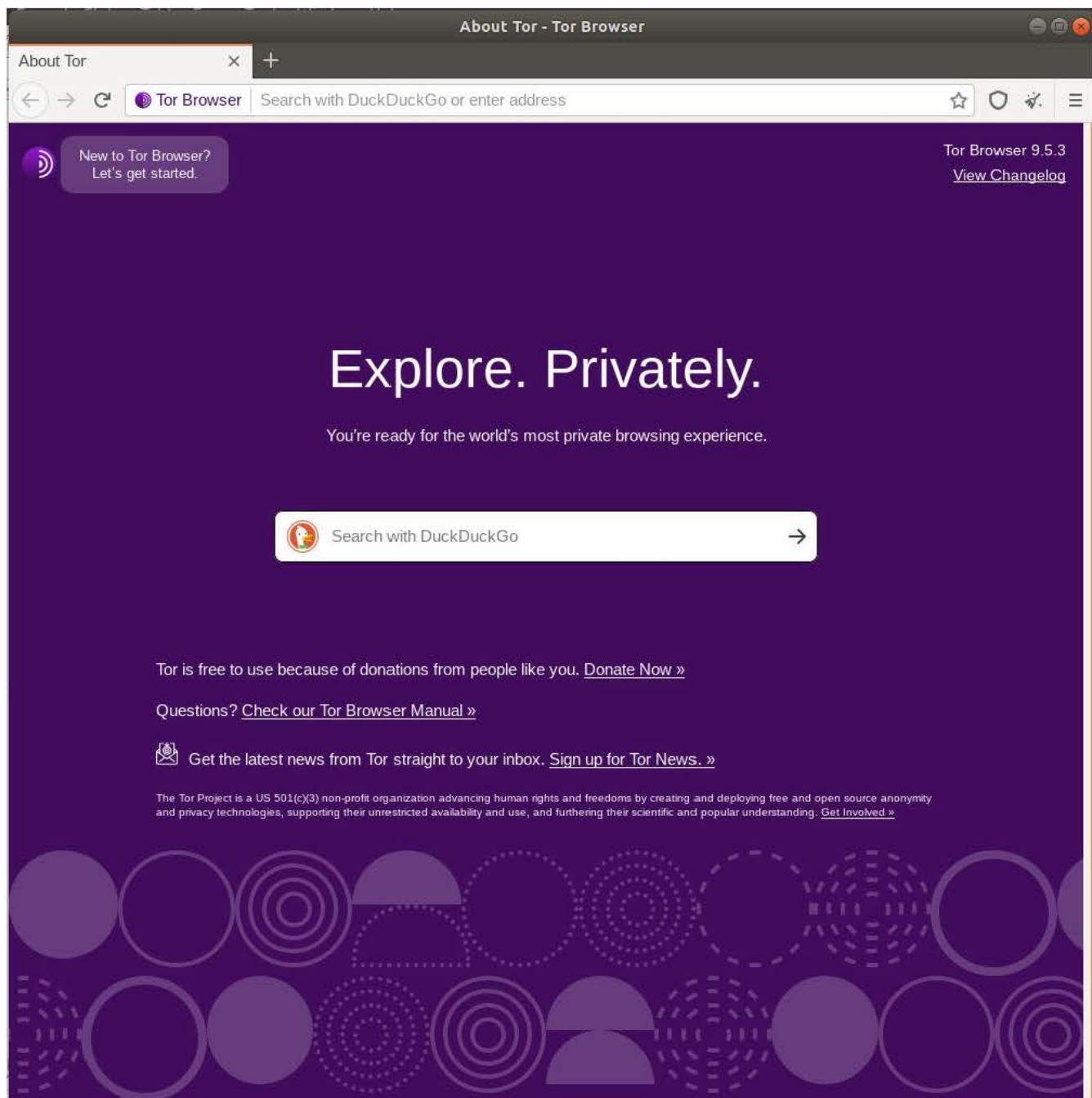
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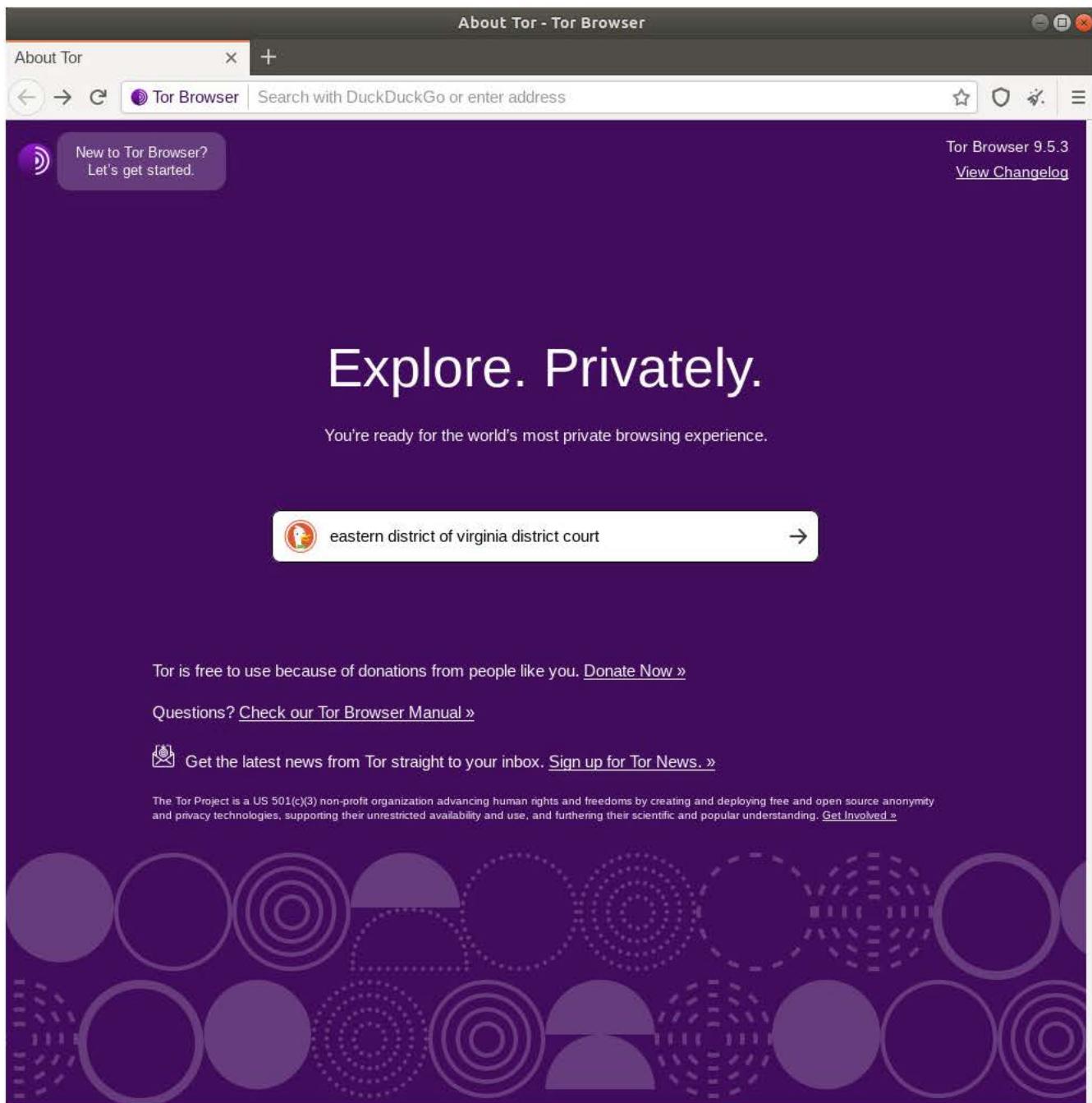
Signature

Download for Linux

Signature

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eastern district of virginia  + 

https://duckduckgo.com/?ia=web

eastern district of virginia u.s. district court 

All Images Videos News Maps Settings   

Germany  Safe Search: Moderate  Any Time

**Eastern District Court of Virginia**  
 [www.vaed.uscourts.gov](http://www.vaed.uscourts.gov)

Welcome to the official web site of the United States District Court for the Eastern District of Virginia. This site is designed to provide convenient and easy access to information about the court and its operations. Thank you for taking the time to visit this web site.

**Eastern District Court of Virginia**  
 [www.vaed.uscourts.gov/locations/ale.htm](http://www.vaed.uscourts.gov/locations/ale.htm)

In case of inclement weather, the U.S. District Court, Eastern District of Virginia, Alexandria Division (Alexandria Division), does the following: The Alexandria Division is closed if the Office of Personnel Management (OPM) announces that the federal government is closed.

**Eastern District Court of Virginia**  
 [www.vaed.uscourts.gov/ecf/index.html](http://www.vaed.uscourts.gov/ecf/index.html)

March 21, 2019 Civil Returns of Service- Effective March 21, 2019 new procedures in regard to attorneys docketing civil returns of service take effect. Please follow the link below for procedures. Civil Returns of Service; November 21, 2018 CM/ECF - Access to Case Information and Document by Third Party Services - CM/ECF filers should be aware of the potential to inadvertently share restricted ...

**United States District Court for the Eastern District of ...**  
 [https://en.wikipedia.org/wiki/U.S.\\_District\\_Court\\_for\\_the\\_Eastern\\_District\\_of\\_Virginia](https://en.wikipedia.org/wiki/U.S._District_Court_for_the_Eastern_District_of_Virginia)

The United States District Court for the Eastern District of Virginia (in case citations, E.D. Va.) is one of two United States district courts serving the Commonwealth of Virginia. It has jurisdiction over the Northern Virginia, Hampton Roads, and Richmond metro areas and surrounding locations with courthouses located in Alexandria, Norfolk, Richmond and Newport News (whose judges are shared ...)

**Videos**

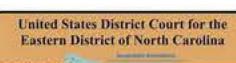
  



Exhibit C

phpBB • Support Forums - Mozilla Firefox

phpBB • Support Forums X + https://www.phpbb.com/community/viewforum.php?f=551

**phpBB** forum software

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Board Index < Support Forums

### Support Forums

FORUM	TOPICS	POSTS	LAST POST
<b>[3.3.x] Support Forum</b> Get help with installation and running phpBB 3.3.x here. Please do <b>not</b> post bug reports, feature requests, or extension related questions here. Subforums: <a href="#">[3.3.x] Convertors</a> , <a href="#">[3.3.x] Translations</a>	1521	10100	<b>Re: How to increase PDF file ...</b> by Lumpy Burgerluschie Tue Aug 18, 2020 4:34 am
<b>[3.2.x] Support Forum</b> Get help with installation and running phpBB 3.2.x here. Please do <b>not</b> post bug reports, feature requests, or extension related questions here. Subforums: <a href="#">[3.2.x] Convertors</a> , <a href="#">[3.2.x] Translations</a>	10044	65565	<b>Re: General Error Message</b> by warmweer Mon Aug 17, 2020 8:08 am
<b>Custom BBCODE Development and Requests</b> Get help developing custom BBCODEs or request one. Subforum: <a href="#">Validated BBCODEs</a>	694	7696	<b>Re: Is there a way to make a ...</b> by Bruce Banner Mon Aug 17, 2020 1:09 am

ACTIVE TOPICS	REPLIES	VIEWS	LAST POST
<b>Mobile Tabs Error In 3.3.1</b> by <a href="#">HIFIKabin</a> » Wed Aug 12, 2020 9:47 am	0	432	by <a href="#">HIFIKabin</a> Wed Aug 12, 2020 9:47 am
<b>Information for (new) translators (Update 10.04.2018)</b> by <a href="#">Crizzo</a> » Sun Jan 01, 2017 5:38 pm	1	49316	by <a href="#">Crizzo</a> Tue Apr 10, 2018 8:14 pm
<b>Language Iso-tag and directory name</b> by <a href="#">Crizzo</a> » Thu Nov 10, 2016 4:29 pm	0	42411	by <a href="#">Crizzo</a> Thu Nov 10, 2016 4:29 pm
<b>Custom BBCODEs [Deprecated]</b> by <a href="#">Marshalrusty</a> » Tue Sep 11, 2007 3:34 am	3998	1129365	by <a href="#">poultrymatters</a> Tue Oct 16, 2012 10:01 pm
<b>How to Increase PDF file size allotment</b> by <a href="#">wanna beco</a> » Mon Aug 17, 2020 7:06 am	7	132	by <a href="#">Lumpy Burgerluschie</a> Tue Aug 18, 2020 4:34 am

phpBB • Support Forums - Mozilla Firefox

phpBB • Support Forums

https://www.phpbb.com/community/viewforum.php?f=551

by leopetrieon » Sun Aug 16, 2020 2:49 am

After updating to 3.3.1 I have problem with mobile menus by Alta967 » Tue Aug 11, 2020 8:04 am

404 Error - New Installation by firegart » Sun Aug 16, 2020 12:00 am

Forum update by Jeffrey Kroonenberg » Sun Aug 16, 2020 8:06 pm

Is there a way to make a BBCode token optional? by Bruce Banner » Sat Aug 15, 2020 4:01 pm

Enable Debug, SQL Explain and Load time by Lady\_G » Sun Aug 16, 2020 11:48 pm

updating from 3.2.9 to 3.3.1 by R\_Ocelot » Wed Aug 12, 2020 9:56 pm

Error after updating from 3.3.0 to 3.3.1 by Vuuzqli » Sun Aug 16, 2020 12:48 pm

PHPBB3.3 To 3.3.1 - Installing Update by mrix2000 » Sat Aug 08, 2020 8:04 am

phpBB Directory wrong by Jeffrey Kroonenberg » Sun Aug 16, 2020 7:02 pm

Rebuilding search index for large forum by olseng » Mon Jun 01, 2020 2:13 pm

Mon Aug 17, 2020 8:08 am

by ssi » Mon Aug 17, 2020 5:55 am

by firegart » Mon Aug 17, 2020 4:51 am

by Jeffrey Kroonenberg » Mon Aug 17, 2020 1:25 am

by Bruce Banner » Mon Aug 17, 2020 1:09 am

by Lady\_G » Tue Aug 18, 2020 1:46 am

by R\_Ocelot » Sun Aug 16, 2020 10:46 pm

by warmweer » Sun Aug 16, 2020 9:30 pm

by Ulkhor » Sun Aug 16, 2020 8:51 pm

by KevC » Sun Aug 16, 2020 7:32 pm

by olseng » Sun Aug 16, 2020 7:14 pm

23 1047 1 2

10 300 1 2

7 189 1 2

5 335 1 2

2 124 1 2

20 638 1 2

6 199 1 2 3

33 1199 1 2 3

6 129 1 2

6 381 1 2

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